

🔗 <https://zen.yandex.ru/media/id/5e4ac3dd5033cf582d873b74/81-skolko-nujno-osvetitelnyh-...>

🕒 18 min read

## 81. How many lighting fixtures do you need to create the effect of the sun on the lunar surface in the pavilion?

Continuation of the previous article: [80. What kind of lighting device simulated the light of the sun in NASA's "lunar" images?](#)

\*

It's no secret that NASA filmed the Moon Landing in the pavilion. An interesting question is: how many instruments did NASA use to simulate the sun's light in the pavilion, supposedly on the lunar surface? Was it one powerful device or were several dozen lamps used?

To answer this question, let's see how many lighting fixtures were used when shooting films in the 60s of the twentieth century when it came to shooting large spaces in the pavilion. Let's take examples from well-known films - "War and Peace" (1965-1967) by Sergei Bondarchuk and "2001. A Space Odyssey" (1968) by Stanley Kubrick.

In the film "War and Peace" there is a scene of Natasha Rostova's ball. We see a gigantic hall, lit as if by candles in chandeliers.



A still from the film "War and Peace".

A still from the film "War and Peace".

Although candles are lit in the chandeliers, in reality the main light comes from above, from the lighting fixtures on the suspended scaffolding.



Working moment of filming one of the balls. Photo from the archives of the Mosfilm Cinema Concern.



Working moment of filming one of the balls. Photo from the archives of the Mosfilm Cinema Concern.

In addition, the pavilion had appliances installed on the sides.



A lot of light was required, since the sensitivity of color negative films in those years was rather low. S. Bondarchuk planned to shoot this scene in the Tauride Palace. But it was not possible to agree on the filming. The hall where Natasha Rostova's first ball took place was planned to be built in the 1st pavilion of Mosfilm. However, this was hampered by technical difficulties. The especially powerful lighting required for the shooting of the ball required the placement of a large number of lighting equipment **weighing about 60 tons** , which could significantly exceed the capabilities of the forests of the 1st pavilion.

In this regard, on November 26, 1964, the chief engineer of the Mosfilm film studio held a meeting, at which it was proposed to comprehensively prepare the First Pavilion for filming Natasha Rostova's ball. As a result of the meeting, it was decided to instruct the chief mechanic of Mosfilm V. Vysotsky to calculate the load on the scaffolding of the 1st pavilion, to give an opinion on the condition of the floors in the pavilion, and to the artists - *"to decide on the placement of operator points and lighting equipment ... to make layout of the scenery "* . And:

... 5. Take into account the statement of power engineers that they undertake to provide the first pavilion with electricity.

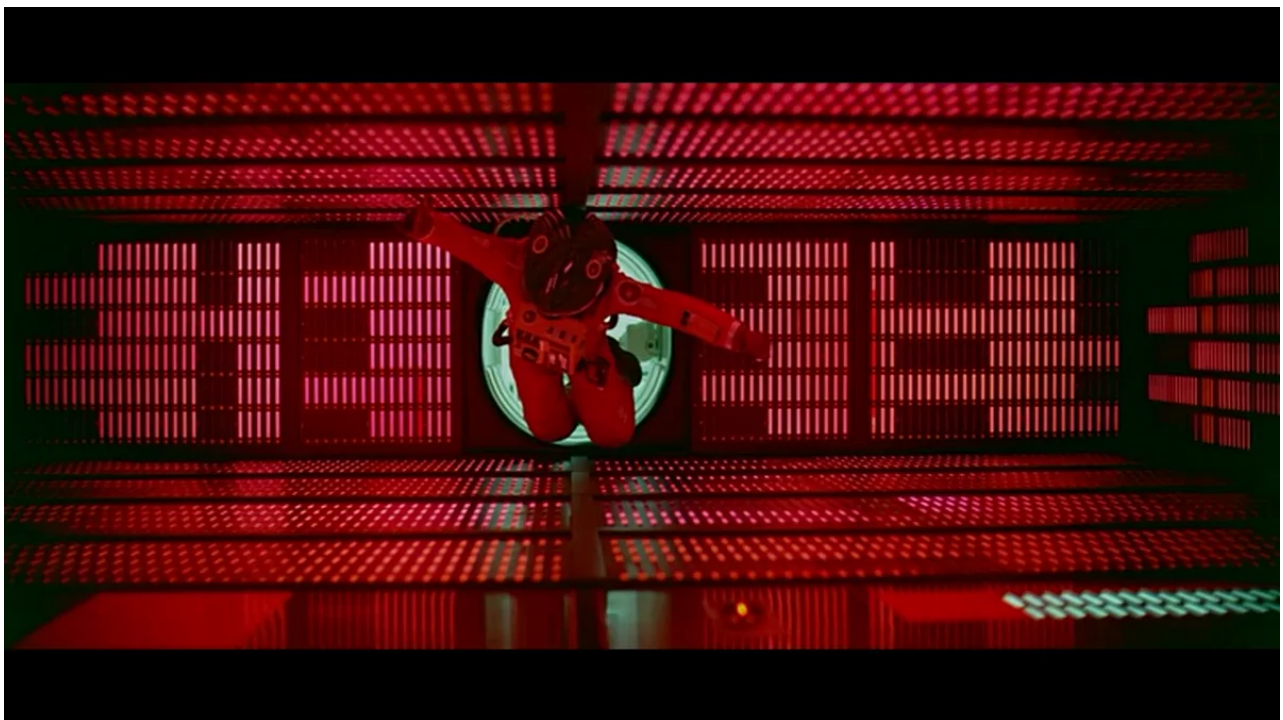
6. To oblige the design bureau of the studio, in accordance with the terms of reference of the lighting engineering department, to develop the design of the winches and the suspension of the ceiling lights, and to manufacture them for the mechanical workshop.

*I quote from Minutes of the Meeting of the Chief Engineer of the Mosfilm Film Studio dated November 26, 1964*

However, one should not think that such a large number of lighting devices were used only in Soviet cinema. Take the foreign film 2001. A Space Odyssey.

Information about the lighting equipment on the project can be found in the book by Michael Benson "A Space Odyssey 2001. How Stanley Kubrick and Arthur Clarke Created a Cult Film" and from the magazine American cinematographer.

HEL's "Brain Room" was a four-story rectangle and was built in Pavilion 6 of dark gray metal sheets with a hundred holes spaced evenly and illuminated with red-orange light. The mesh support rig was surrounded by 20 evenly spaced 10 kW floodlights. (We wrote about the use of 10-kilowatt lighting devices in([See previous article](#).) The light was so bright that it was almost impossible to look at the towering structure from the side. The temperature inside rose above 32 degrees.

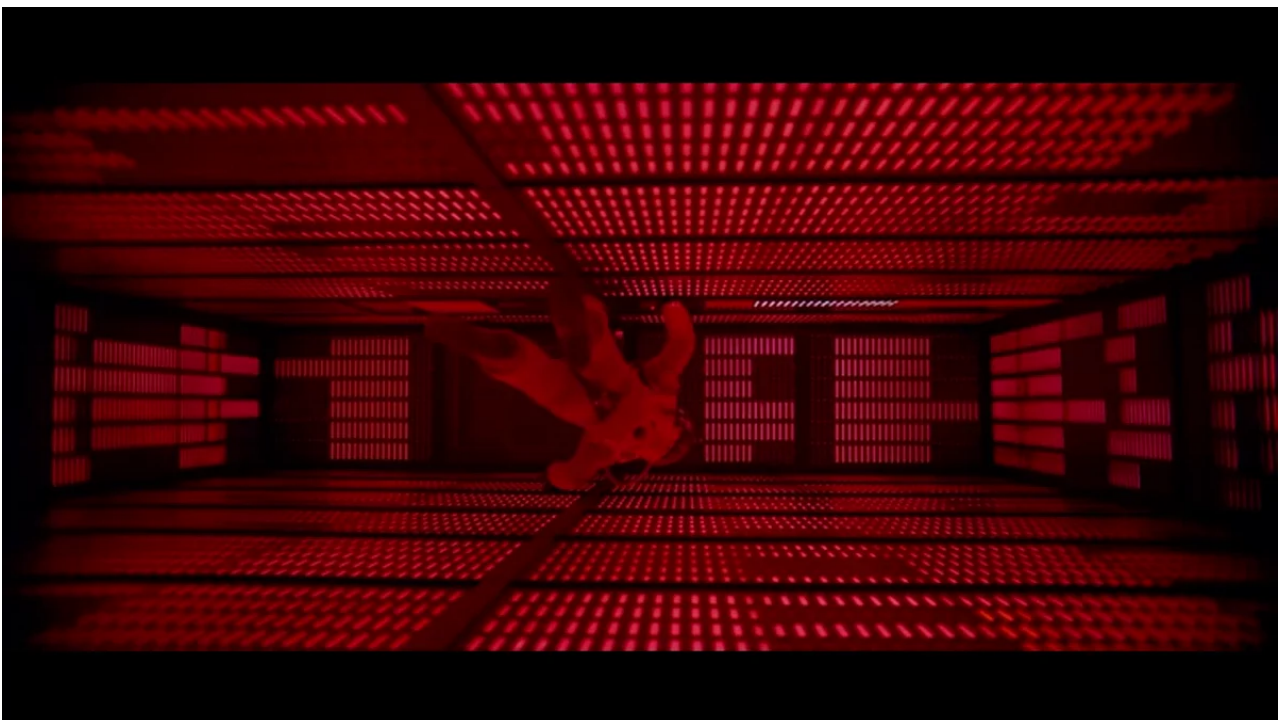




When the outside lights were lit, HAL's brain was illuminated from all sides so that it looked, according to cameraman Kelvin Pike, like a toaster from the inside. The protagonist, Dulli, had to "kill" HAL by flying into the hatch and methodically disconnecting the higher brain functions while the computer asked him to keep him alive.

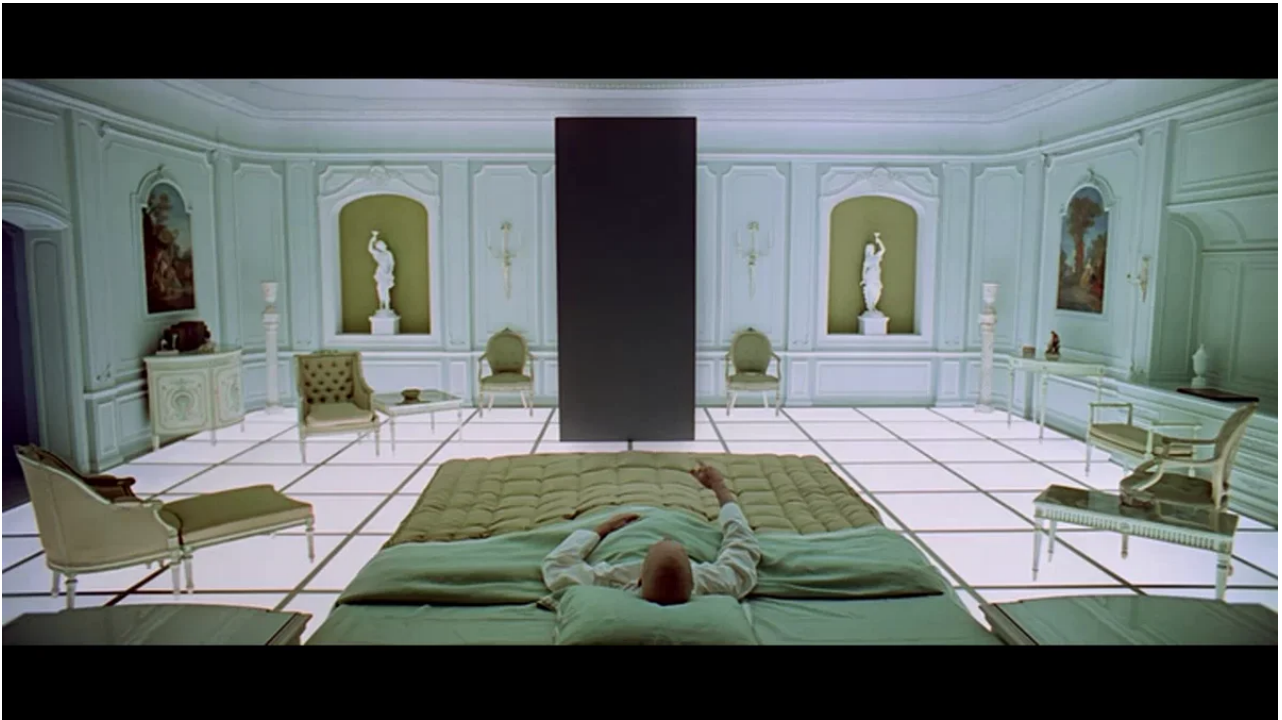


When filming a general plan, the actor was suspended on one strand of wire, in this frame no special acrobatics were needed.

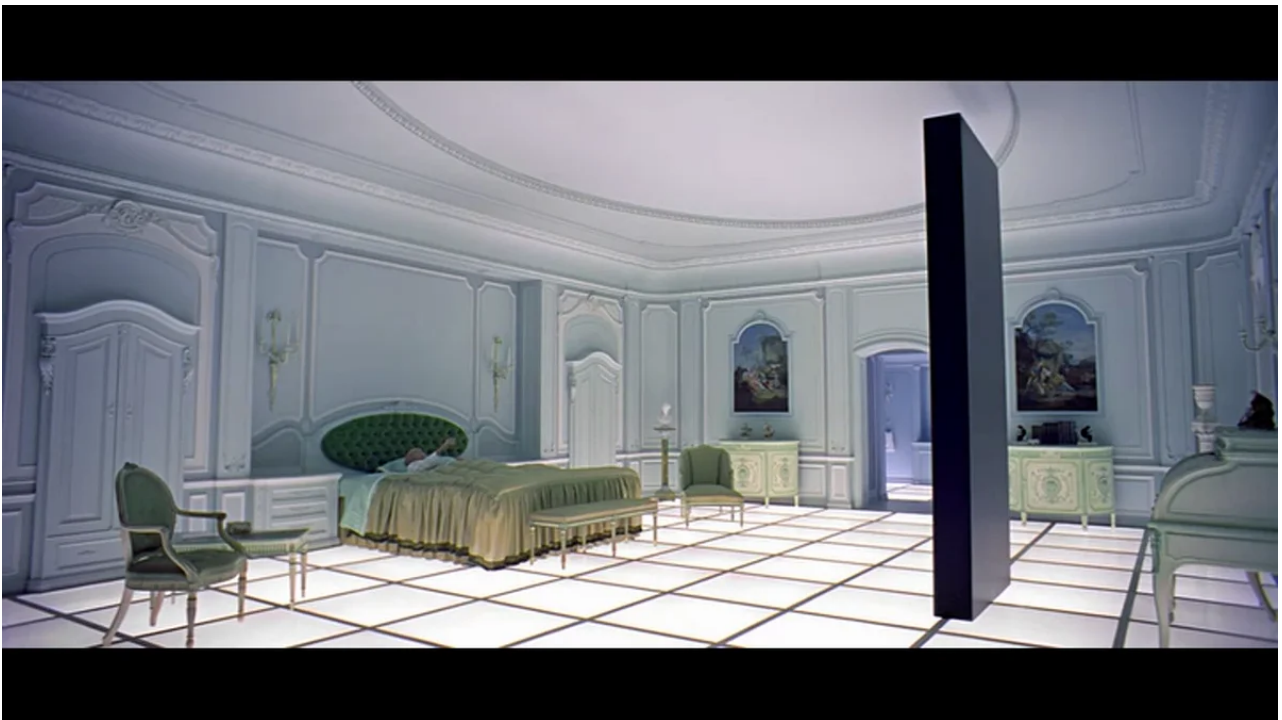




At the end of the film, a French-style bedroom appears, where the protagonist sees himself in old age.



This scene included the last meal of an 80-year-old man and the last breath of a man in his 90s.



The set was set up in Pavilion 4 using steel tubes that were suspended approximately 4 meters above the studio floor to accommodate the floodlights. The floor of the set was made of plexiglass, square tiles. Lighting was achieved thanks to 370 thousand watts

shining from below, which created something like the Sahara for the team inside, the temperature reached +34 degrees. Spotlights periodically warped the tiles, which had to be replaced.

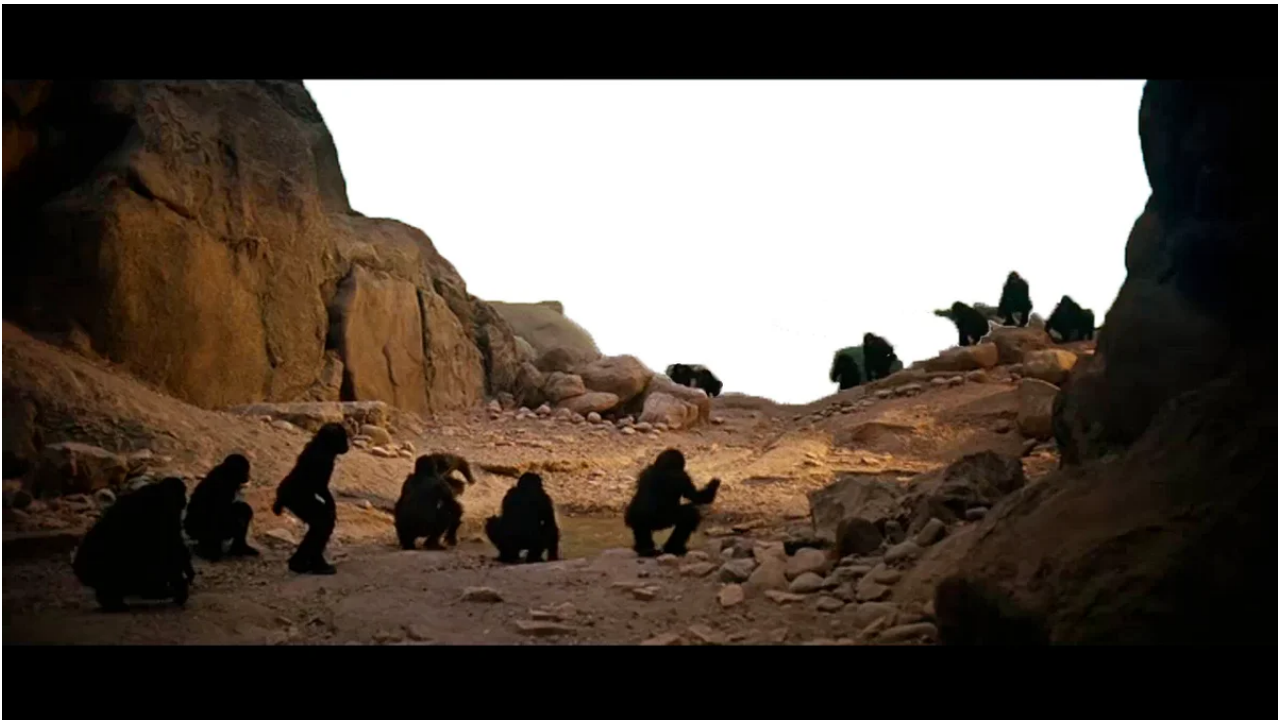
Even more light was used in the prologue of A Space Odyssey, in The dawn of man, which used front projection. Front projection has never been used on this scale. A landscape in the background (distant mountains and boulders) is an image from a slide projector on a vertically hanging movie screen.



A still from the prologue of the film "2001. A Space Odyssey".

A still from the prologue of the film "2001. A Space Odyssey".

And the front part with the acting stage is the decoration in the pavilion.



The projection onto a special reflective screen (made of scotch tape) comes from the front, from the same direction from which the movie camera is filming (and in fact from the same place), therefore this method of obtaining a combined frame is called front projection.



Work moment. A reflective screen hangs in the background. To simulate the light of the setting sun, yellow-orange filters were installed on the spotlights.



Work moment. A reflective screen hangs in the background. To simulate the light of the setting sun, yellow-orange filters were installed on the spotlights.

Landscapes taken in South Africa were projected onto a giant screen at sunrise or sunset. It was assumed that the foreground would be mostly in the shadows, and the background in the light.



But these shaded areas weren't really in shadow. In fact, they were illuminated from above, this light should be absolutely even, as is usually the case with light from the sky. Every effort had to be made to avoid the numerous shadows produced by the artists - an instantly visible sign that the action was taking place in the studio.

“The only way was to make the entire ceiling above the stage a big white sky,” cinematographer John Alcott recalled.

Illuminator Bill Jeffrey hung reflective balls on the ceiling - 500-watt photo lamps. There were 37 rectangular containers on the ceiling with balls inside, each container the size of a headboard and each containing 50 bulbs. All bulbs had a switch at the bottom, for a total of 1850 switches. This made it possible to very accurately turn off any overheated places, since all structures on the stage were firmly fixed.



All lighting technology absorbed 25,000 watts per container. There were 37 of them, which means that the capacity of the entire ceiling was 925,000 watts. This did not include the number of side lamps, which gave the effect of distributing light from the horizon. For the upcoming monkey fight scene alone, 9 lighting fixtures were prepared, each 25,000 watts, that is, the side light equaled 225,000 watts. Together with the ceiling, there were 1.5 million watts for lighting the "Dawn of Humanity".

Not surprisingly, the temperature on the site soon rose above +38 degrees - the same in the Namibian desert in summer.

” Worried that such conditions would kill all the energy of the artists, Kubrick ordered a huge soda fridge. He also tried another trick, which was soon found unacceptable.

” “They found a large fan that worked very weakly so as not to raise dust,” Woods recalls. “They hammered him with some unprecedented amount of dry ice and sent him at us.” But soon, due to the difference in temperature, the bulbs began to explode, and, seeing a stream of glass falling from the African sky, Kubrick ordered to remove the apparatus. Richter's Pithecanthropus were destined to experience the real conditions of the African desert.

From the notes to the shot, it can be understood that an orange W-85B filter (numbering by the Retten catalog, Wratten) was used to simulate the light of the setting sun.

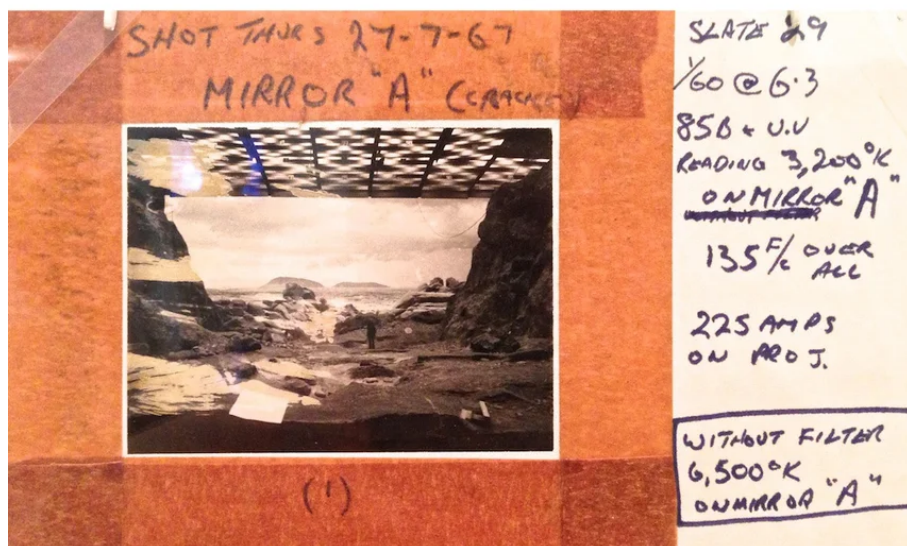


Light filter W-85B

Light filter W-85B

In the slide projector, an intense burning arc was used as a light source, the current strength reached 225 amperes. The light came through a semitransparent mirror (this is the front projection technology), therefore "MIRROR" is mentioned in the description of the frame.

СЪЁМОЧНЫЙ КАДР ОТ 27 ИЮЛЯ 1967 ГОДА



ВЫДЕРЖКА 1/60 С,  
ДИАФРАГМА 1:6,3  
НА ОСВЕТИТЕЛЬНЫХ ПРИБОРАХ  
УСТАНОВЛЕН ЖЁЛТО-ОРАНЖЕВЫЙ  
ФИЛЬТР W-85B, КОТОРЫЙ  
ПОНИЗИЛ ЦВЕТОВУЮ ТЕМПЕРАТУРУ  
ДО 3200 КЕЛЬВИН

135 фут-канделл

СИЛА ТОКА НА ПРОЕКТОРЕ  
225 АМПЕР

БЕЗ ФИЛЬТРА  
НА ЗЕРКАЛЕ "А"  
6500 КЕЛЬВИН

Comments to the frame

Comments to the frame



*What is further written in italics and with a left vertical line, 3 paragraphs - is the calculation of the illumination on the set. If you don't like calculating, skip these 3 paragraphs.*

- The illumination on the set was **135 F / s over all** , i.e. the illumination in the spotlight beam differed from the illumination of the foreground "ground" (light from the "sky") by 135 foot-candles.



” Is it a lot or a little - 135 ft-candles? Let's translate the meaning into the suites we are used to - this is 1450 lux. What was the overall illumination? The answer to this question is quite simple, since the description for the frame indicates the shutter speed of 1/60 s and the aperture of 6.3. In addition, we know the sensitivity of the film, 100 ASA. Apparently, it was Kodak-5247. I didn't have tables of key illumination for a sensitivity of 100 units at hand, but I did have a Kodak table for a film sensitivity of 200 units.

## 2. таблица выдержек при падающем свете

- скорость камеры: 24 изображения/с
- obturator открыт на 170°
- экспозиционный индекс: 200

Эта таблица используется при съемке объекта, содержащего светлые, средние и темные части. Когда объект содержит светлые зоны, надо закрыть

диафрагму, по крайней мере, наполовину. И, наоборот, темный объект требует более значительного открытия.

отверстие диафрагмы	1	1,4	2	2,8	4	5,6	8	11	16
необходимое число люкс	64	125	250	500	1 000	2 000	4 000	8 000	16 000

Key illumination table for Kodak film with a sensitivity of 200 units.

Key illumination table for Kodak film with a sensitivity of 200 units.

“ If a film of 200 units requires 4000 lux at an aperture of 8, then for a film of 100 units and at the same illumination (4000 lux), you need to open the lens by one stop, that is, set 5.6. And since the shooting was carried out at an aperture of 6.3, the light is required by 1/3 more than at an aperture of 5.6, that is, not 4 thousand, but about 5 thousand lux. Thus, where the spotlights fell, the illumination was approximately 5000 lux, and in the foreground it was 1450 lux less, that is, approximately 3600 lux. Is it a lot or a little 5 thousand lux? Let's compare with the values we know. Typically, a house has 150 lux in the evenings.

**СНИП 23-05-95**  
**Нормы освещённости жилых помещений**  
НЕ МЕНЕЕ

150лк	150лк	50лк	30лк	20лк	20лк
комната	кухня	туалет	вестибюли	коридоры	лестницы

Building codes and regulations for room illumination.

Building codes and regulations for room illumination.

” This means that on the set, the illumination was about 30 times higher than in the room with the chandelier turned on. But it is several times lower than on a real sunny day, when the illumination in the middle of the day rises to 40,000 - 50,000 lux. Thus, the illumination on the set, where the "daytime" frame was created, was very high, but nevertheless, about 8-10 times lower than during the day under the sun's rays.

Front projection technology has been applied in many lunar shots. As a matter of fact, Kubrick was developing this technology on behalf of NASA. Shooting of the film "2001. A Space Odyssey" is a cover operation where, under the guise of filming a fantasy film, technology was developed that would be used to falsify lunar materials. Such shots, when the actors in the pavilion are in the foreground, and the "lunar" mountain landscape is projected into the background, must be worked out in all the details. The most important thing is to match in color and texture the decoration in the pavilion with the texture and color of the mountains on the slide. And Kubrick takes pictures like that. Only instead of a real lunar landscape, he uses a very similar to the lunar, mountainous landscape of the Namibian desert (located in southwestern Africa),



"2001. A Space Odyssey". A shot from the prologue.

"2001. A Space Odyssey". A shot from the prologue.

And this mountain landscape should be illuminated by a low sun with long shadows, since, according to legend, the landing of astronauts on the moon should take place at the beginning of a lunar day with a sun height above the horizon of 18-30 °.





"2001. A Space Odyssey". A shot from the prologue.

"2001. A Space Odyssey". A shot from the prologue.

When we look at the "lunar" images obtained by the front projection method, for example, a frame from the album "Apollo 15", we clearly see the border that separates the foreground fill soil from the vertical plane of the cinema screen in the background.



A still from the Apollo 15 album with front projection applied.

A still from the Apollo 15 album with front projection applied.

We wrote about this in detail in the article [25. The most famous lunar photograph from the Apollo 15 mission was taken in the pavilion by the front projection method.](#)

There are a lot of such pictures, where the use of front projection is clearly visible, in the Apollo albums. We found pictures with front projection not only in the Apollo 15 album, but also in the Apollo 16 and Apollo 17 missions, as reported in the article [5. The Americans filmed different landings on the moon in the same pavilion.](#)

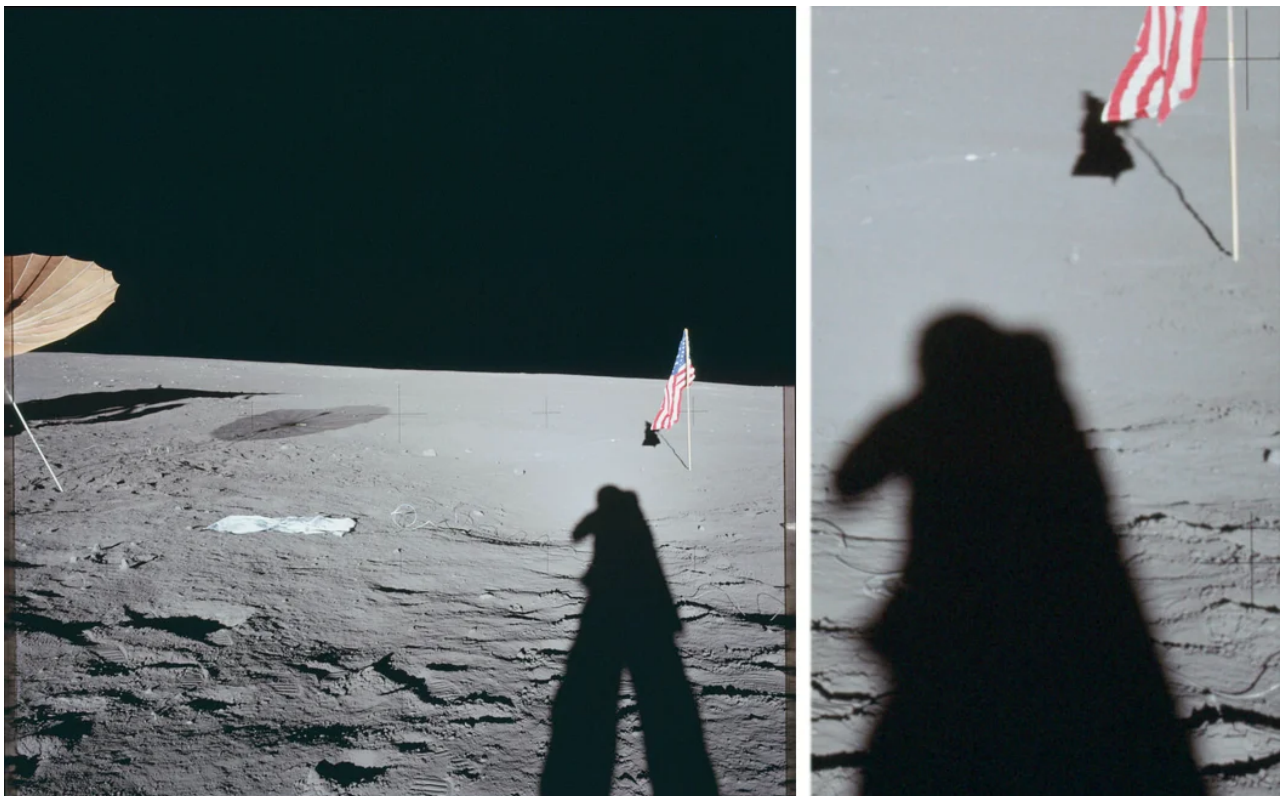


Now we can estimate the approximate amount of light involved in shooting "moon" frames. We can say that the illumination on the site where the "lunar" landscape was created was about 10 times lower than on the real moon. And maybe even a little more, because on the Moon, where there is no atmosphere, the illumination can reach 100,000 lux.

There is a question that defenders of the lunar scam always ask: "If the shooting of the lunar frames "was carried out in the pavilion, and the lighting device shone on the stage from above, then at what height was the ceiling of the pavilion? less than 100 meters. How can you make a pavilion with such a high ceiling? "

At first glance, the pavilion really turns out to be simply incredible in size. Let's count a little.

Where do you need to move the anti-aircraft searchlight so that it gives the same "natural" blur of the shadow, as if on a sunny day?



The astronaut's shadow blurred with distance.

The astronaut's shadow blurred with distance.



To obtain such a blurring effect of the shadow, the luminous body of the lighting device must be observed at the same angle as the sun, i.e. half a degree. Since a parabolic mirror with a diameter of one and a half meters is used in an anti-aircraft searchlight to obtain a narrow beam of light, it is easy to calculate that this luminous object needs to be removed by about 170 meters.

And if you take actors who are 30-40 cm shorter than real astronauts, i.e. 20% lower, then it is enough to move the device away already by 120-130 meters.

But to simulate a 27-30 ° angle of rise of the sun, a mast with a height of about 85 meters is needed. This is a 30-storey building in height.



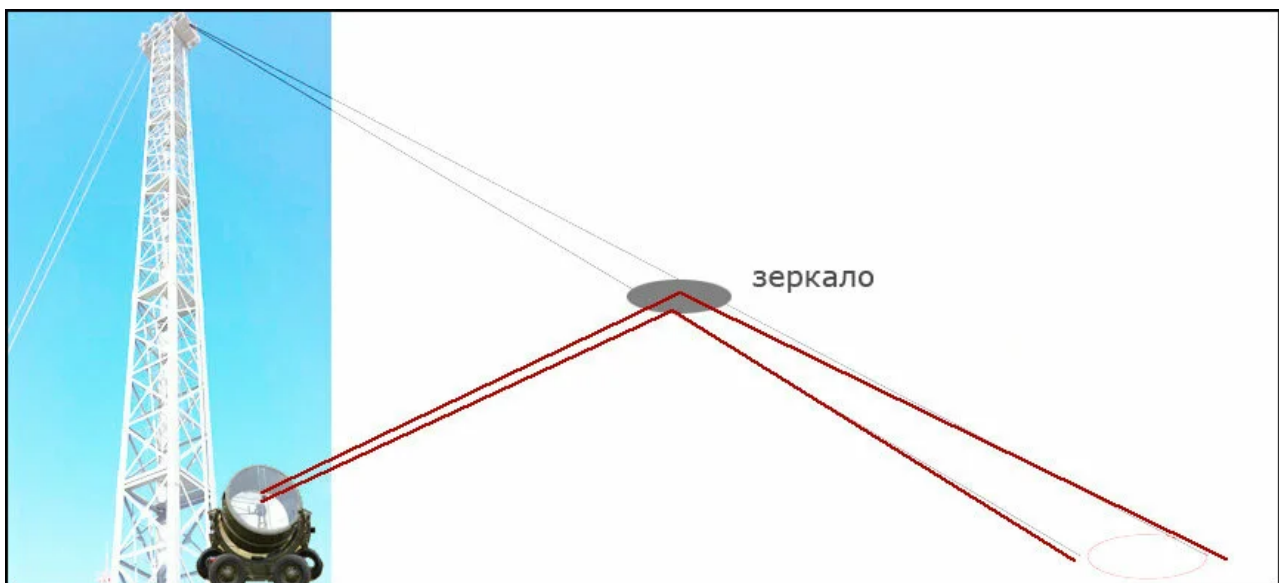
30-storey house

## 30-storey house

At such a height, you will have to pull powerful electric cables for lighting arc devices, and change the burning coals every hour. This is technically doable. As well as mounting an external lift (for a small rise and fall of the lighting device), with the help of which it would be possible to recreate in the pavilion the change in the height of the sun that occurs on the moon during 20-30 hours of astronauts stay. But what is really impossible to do is to build a pavilion so high that the roof is at the level of the 30th floor, and the pavilion itself would be at least 200-300 meters wide. In addition, there should be no columns supporting the roof inside the pavilion, otherwise they will be in the frame. No one has ever built such hangars. And it is hardly possible to build.

But filmmakers wouldn't be filmmakers if they hadn't found an elegant solution to such a technically impossible task.

It is not necessary to raise the lighting fixture itself to that height. He can stay on the ground, more precisely, on the floor of the pavilion. And upstairs, to the ceiling of the pavilion, you only need to raise a mirror.



Simulate the light of the sun with a light on the ground.

Simulate the light of the sun with a light on the ground.

With this design, the height of the pavilion is reduced by 2-3 times, and the length of the path from the lighting device to the shooting location remains the same.



If we recall that in the Apollo 11 and Apollo 12 expeditions, the height of the sun rise is only 18-20 °, then it is easy to calculate that the mirror should be placed at a height of only 19 meters.

Go to any major cinema, at least IMAX at the "River Station" in Moscow. There is a screen as high as a 7-storey building. Ceiling height of 20 meters is the most common occurrence in cinemas.



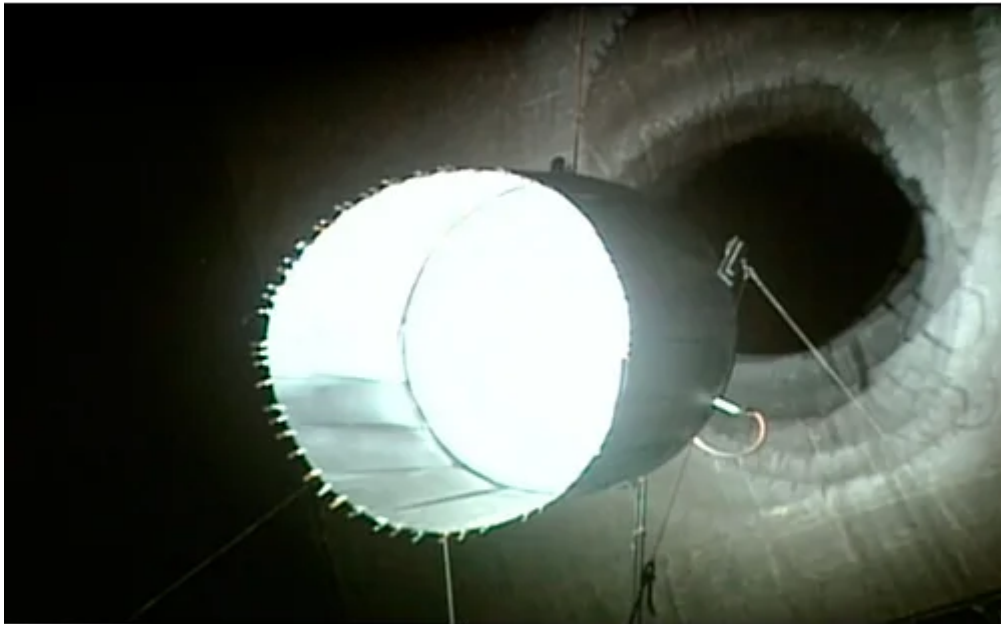
Cinema at the "River Station".

Cinema at the "River Station".

When the giant lighting fixture is on the ground and there is only a mirror under the ceiling, it is easy to operate. Moreover, instead of one lighting fixture, you can put several fixtures at once. For example, in the 12-episode film "From the Earth to the Moon" (1998, produced and starring - Tom Hanks), 20 lighting fixtures with xenon lamps with a capacity of 10 kW located next to each other. Total - 200 kilowatts.



The light beams from the searchlights were directed into a spherical mirror with a diameter of 2 meters, hanging from the ceiling of the pavilion.

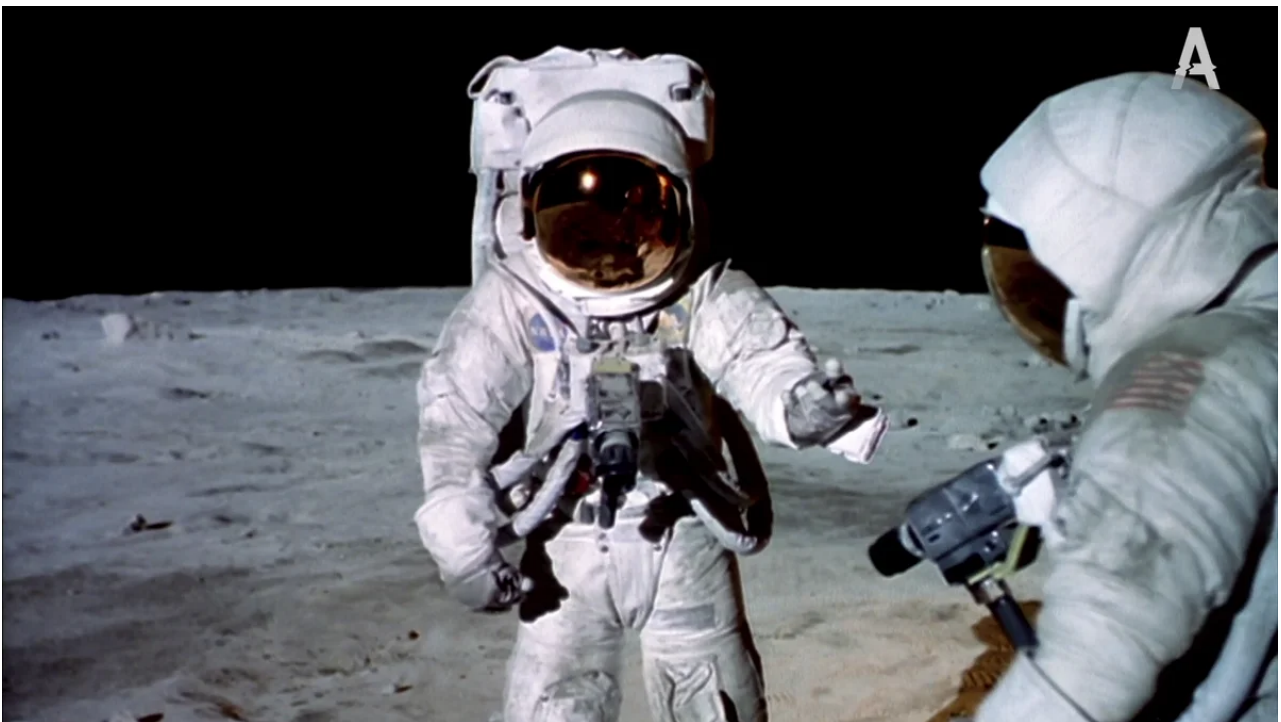


Creation of the light of the sun "on the moon" in the pavilion with the help of 20 lighting devices and a spherical mirror under the ceiling.

Creation of the light of the sun "on the moon" in the pavilion with the help of 20 lighting devices and a spherical mirror under the ceiling.

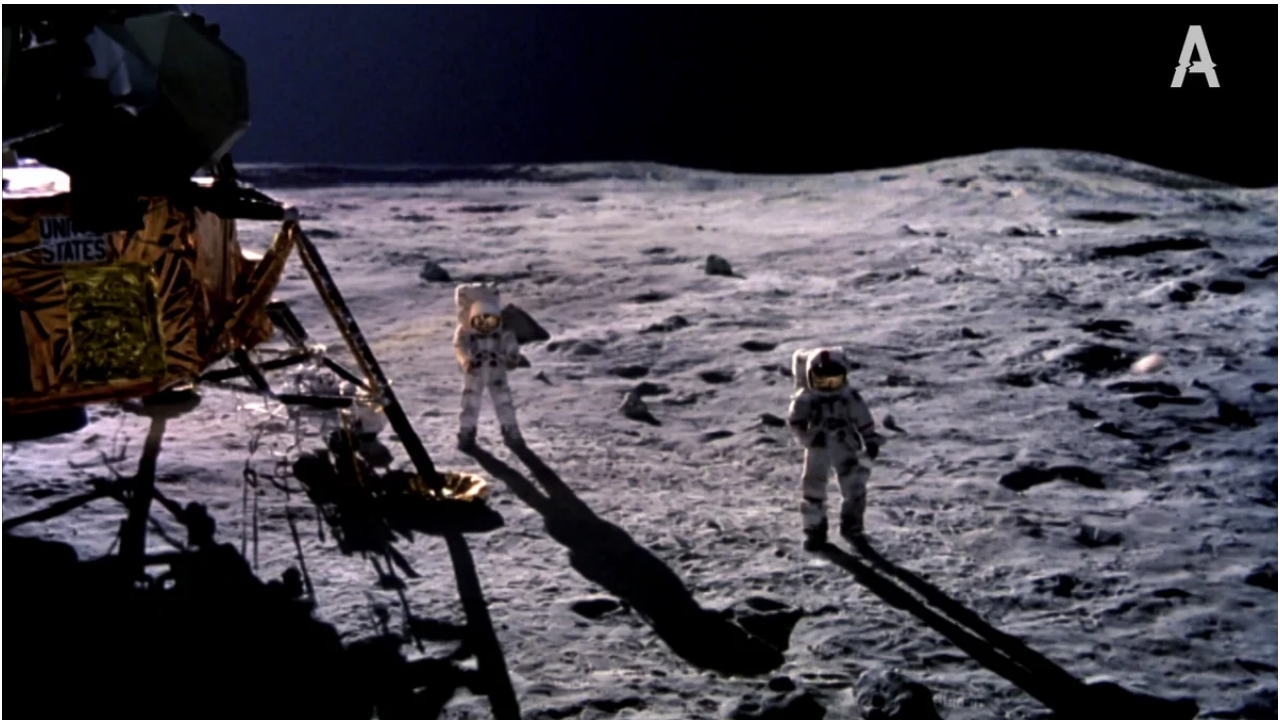
And this is what happened as a result. Stills from the film "From the Earth to the Moon".









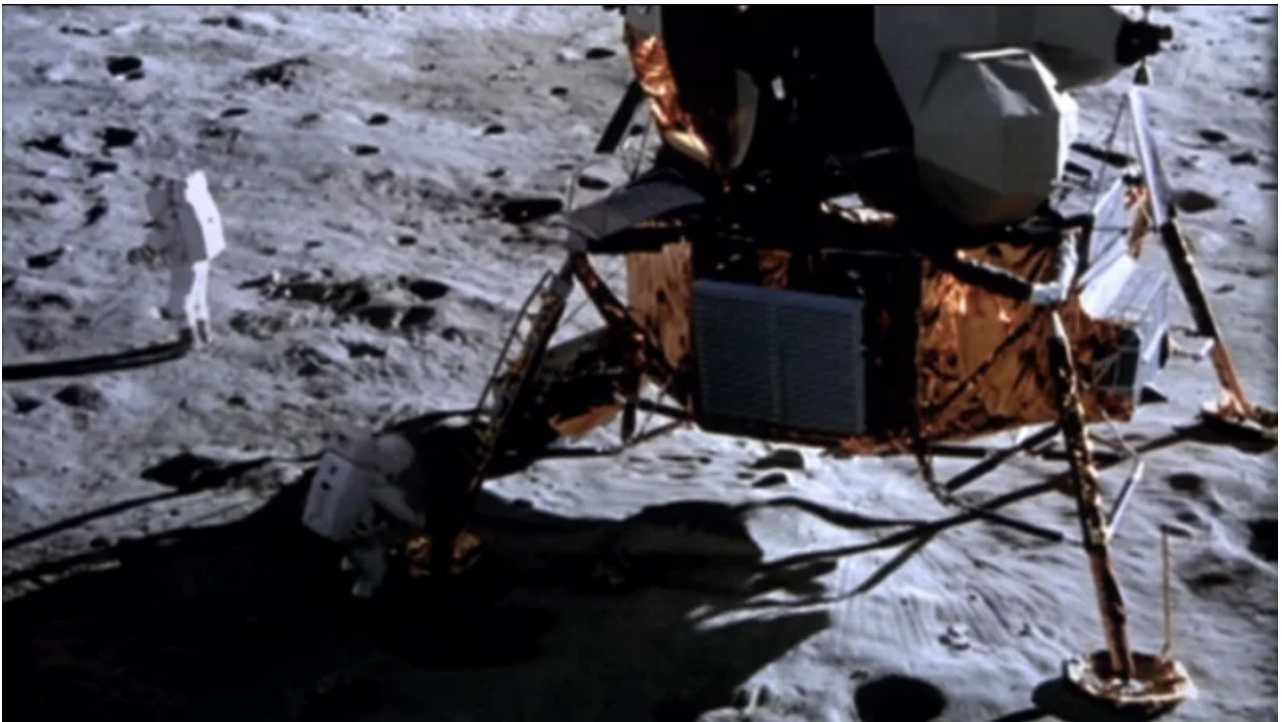












Stills from the film "From Earth to the Moon", 1998

This is how a large space of the lunar surface, illuminated by the sun, can be recreated in the pavilion.

\*

Cameraman L. Konovalov was with you. Until next time!





Generated with Reader Mode